The Impact of the COVID-19 Pandemic on the Presentation of Colorectal Cancer in the Puerto Rican Population

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ABSTRACT

Introduction: Colorectal Cancer (CRC) is the third most common cancer and the second malignancy with the highest mortality rate in the United States. Regular screenings with colonoscopies are useful studies used to detect and diagnose CRC. However, amid the Coronavirus 19 pandemic, regular screening was postponed resulting in delayed diagnosis and treatment for patients with CRC. Objective: The aim of this retrospective study was to analyze and compare the impact of the pre-COVID and COVID periods in the presentation of colorectal cancer. Methods: This retrospective study included 85 patients, whose information was obtained from medical records, 32 in the pre-COVID group and 53 in COVID group. Results: When comparing colonoscopies, more than half of the patients presenting in the COVID period presented with no colonoscopies as opposed to the pre-COVID patients where most presented with recent colonoscopies. Pathology reports showed a double and a triple increase of advanced stages of CRC, III and IV respectively, the COVID period as compared to pre-COVID cohort. Discussion: Moreover, the number of patients presenting with metastasis in the pandemic period showed a 'borderline' significance (OR 0.105, 95% CI 0.01-1.1, p=0.053). There was no significant difference in patient demographics. Conclusion: A future study should include a larger population with data from more clinics in order to validate or refute the actual significance of such findings.

Keywords: colorectal cancer, COVID-19, pandemic, colonoscopies, metastasis, retrospective study

1. Introduction

The COVID-19 pandemic has been a global phenomenon affecting many aspects of our lives, including the medical services we sought and the care we received. As the Pandemic progressed, safety protocols were implemented and routine health maintenance visits were canceled or postponed. This, along with the fear of being exposed and contracting the virus, lead patients to not seek the required medical care in a timely manner. Particularly, cancer patients were some of the most affected by the pandemic. These patients would come to suffer the long-term effects of postponing scheduled screenings for cancer.

Colorectal cancer is the third most common type of cancer and one of the few that has routinary screening tests available [1]. It was reported that during 2020, the average report of cancer diagnoses fell significantly compared to the average number in 2018 and 2019; colorectal cancer (CRC) diagnosis had one of the highest decreases [2]. The patients who went undiagnosed or that received a diagnosis of advanced staging went to account for the vast number of avoidable deaths due to colorectal cancer. In turn, the impediment of screening for CRC also significantly increased the number of patients that presented with metastases, those who underwent neoadjuvant therapies and palliative surgeries, and those with emergency presentations [3].

In this comparative study, we aim to analyze the impact of the COVID-19 pandemic in the treatment, diagnosis and prognosis of colorectal cancer in two-time cohorts, pre-Covid and Covid, to see whether there was a decrease in the amount of preventative screening available, such as colonoscopies, that lead to cancer upstaging and limited treatment outcomes.

2. Methodology

A retrospective medical record search was conducted on all patients from January 2019 to May 2021 that were evaluated at Saint Luke's Memorial Hospital and Bolaños Surgical Services in Puerto Rico with the diagnosis of colorectal cancer. All patients in this study were admitted by the general surgery department and underwent surgical procedures. The database applications from which the medical records were retrieved were Meditech and NeoMed. We sought to obtain a large enough study population to divide it into two periods, a pre-COVID cohort and a COVID cohort. March 2020 was selected as the division between both time periods since it was the time when the Puerto Rican government declared COVID-19 as a national emergency and implemented an island wide lockdown.

The search criteria for patients were based on the following ICD 10 Codes: K63.5 (polyp of colon), C-18 (malignant neoplasm of colon), C-19 (malignant neoplasm of rectosigmoid junction) and C-20 (malignant neoplasm of rectum). Here, information such as patient general information, comorbidities, colonoscopies, surgery performed, surgical approach, COVID test results, pathology TNM staging were analyzed and recorded on the data application RedCap. Patient diagnosis was categorized based on the severity at the moment of presentation.

Patients were included in this study if they were admitted in the established time frame of January 2019 to May 2021 and had a diagnosis of colorectal cancer. The selected exclusion criteria for this study were: (1) having a past medical history of colorectal malignancies, (2) having a family history of colorectal cancer, and (3) being under the age of 21.

2.1 Data Extraction and Outcomes Evaluated and Definitions

The data extracted from MediTech and NeoMed was entered into standardized Microsoft Excel spreadsheets for data tabulation. Data of primary importance included the time interval from which the data was collected for each of the cohorts, the total number of patients, emergency or outpatient department presentation, prior colonoscopies, surgical intervention and the pathology reports for the cancerous tumor including the tumor, node, and metastasis (TNM Classification System).

Secondary data included patient demographics, comorbidities, smoking and alcohol history, vital signs, history of present illness, COVID-19 test results, hospital and intensive care unit length of stay, complications, mortality rate and tumor location.

2.2 Statistical Analysis

The data tabulated in Microsoft Excel was exported into RedCap for further analysis. A cross tabulation was made between pathological stagings (Stage 1, 2, 3, 4) and the period of admission (pre-COVID or COVID) for each group. The number of patients for each pathological staging and the percent of patients with diagnosis of CRC in a particular staging during a particular time period was recorded and totalized.

A chi square test was performed to compare the rate of patients with metastasis in each period of admission. Given our study population and the variables in place, the p value and Odd Ratios (OR) was calculated. All p-values less than 0.05 were considered statistically significant.

3. Results

A total of 85 patients with a confirmed diagnosis of colorectal cancer presented to Saint Luke's Memorial Hospital and Bolaños Surgical Services during the three-year study period were included in our investigation. 53 patients were categorized under the pre-COVID, which included patients admitted from January 2019 to February 2020. In turn, 32 patients were placed under the COVID group, which included patients admitted from March 2020 to May 2021. Most of the selected patients had all the available data required for our study, with only a few exceptions. 53 out of the 85 total patients did not have a known metastasis category in their pathology reports. Also, some patients did not have general information such as BMI, comorbidities, substance use status, etcetera, in their records.

3.1 Patient General Information

As for gender distribution, the pre-COVID group showed a predominance of male patients to female patients, 59% to 41%, respectively. As for the COVID group, there was no significant male:female gender distribution, 51% to 49%. With

regards to patient age, the average age for the pre-COVID group was 69, while in the COVID group it was 62. In terms of Body Mass Index, most patients in both cohorts were classified in the overweight category. Since all patients in this study underwent surgical procedures, their ASA score was calculated upon admission. During the pre-COVID group, most patients presented with an ASA score of either 1 or 2, accounting for 51.7% of the patients. As for the COVID group, the most frequent score was ASA 3 and 4, accounting for 56.6% of patients.

3.2 Patient Comorbidities

The most common comorbidities in both cohorts were hypertension, diabetes, hypothyroidism, obesity and coronary artery disease. These comorbidities were seen in varying frequency and combination among patients. Hypertension was seen in 69% of the patients in the pre-COVID group, while it was seen in 68% of the patients in the COVID group, while diabetes was seen in 31% of the pre-COVID patients and 25% of the COVID patients. Other less common comorbidities seen, accounting for less than 5% of the presentations in both cohorts, were COPD, hyperlipidemia, asthma, epilepsy and chronic kidney disease. Related comorbidities were seen in 87% of the total patient population. Regarding substance use, the majority of the patients from both cohorts, over 80%, reported that they did not smoke nor consume alcohol.

3.3 Patient Presentation

Furthermore, patient presentation in the study was divided into patients arriving through the Emergency Department or as outpatient elective cases. In the pre-COVID, 59% presented electively as outpatient scheduled cases (OPD). Similarly, in the COVID group, most patients 53% also arrived through the OPD. Upon arrival, patients' vital signs were taken along with COVID-19 test. For almost all of the patients in both cohorts, above 96% for each, presented normotensive and with a negative COVID-19 test. In regards to patient profiles, the history of present illness and history of colonoscopies were taken. Patient presentation was further categorized into five history of present illness (HPI) presentation categories: 1) Bleeding, 2) Elective, 3) Obstruction, 4) Pain or 5) Perforation. In the pre-COVID group, the most common HPI presentation was for elective surgeries, accounting for 53%. In the COVID group, only 36.6% of the patients presented for elective surgeries. The remaining 63.4% of the patients presented with the remaining acute clinical presentations requiring surgical intervention, bowel obstructions being the most common at 26.9%.

Figure 1: Percentage of Colonoscopy in the Pre-COVID group (left) and the COVID group (right)
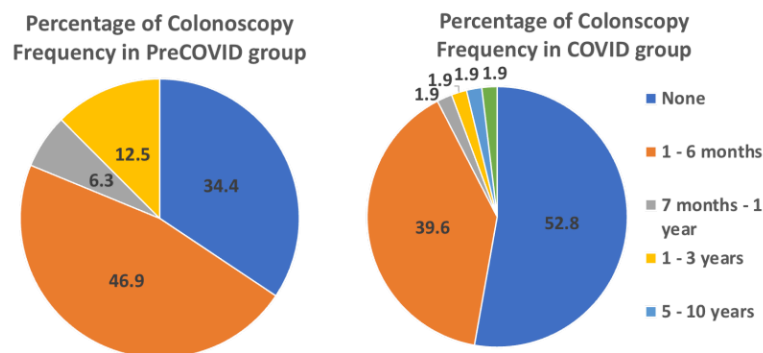
3.4 Colonoscopies

The colonoscopy reviews in this study were based on the 2020 American Cancer Society Guidelines for Colorectal Cancer Screening. These guidelines establish that people at average risk of colorectal cancer should start regular screening at age 45 [1]. After that, colonoscopy screenings should take place regularly every 10 years, for people at average risk. In the study, colonoscopies were categorized into how recently it had been performed: 1) none, 2) 1 month-6 months prior, 3) 7 months- 1 yr prior, 4) 1yr - 4yrs prior, or 5) 5yrs -10yrs prior. In the pre-COVID group, 53.2% of patients had a colonoscopy within the last year before surgical intervention and 34.4% of patients had no colonoscopies. In the COVID group, the percentage of colonoscopies within the last year decreased to 41.5% while the percentage of no colonoscopies increased to 52.8% (Figure 1).

3.5 Surgical Procedures, Tumor Locations and Complications

The surgical procedures that the patients in both cohorts underwent showed that the most common surgery was a hemicolectomy with primary anastomosis, which accounted for 46.1% of surgeries in the pre-COVID group while it accounted for 39.6% of surgeries in the COVID group. The second most common procedure was a low anterior resection, 34.4% of cases in the pre-COVID group and 26.4% of cases in the COVID group. All tumors in the pre-COVID group were operable. In the COVID group, 4 out of the 53 patients had procedures in which the tumors were determined to be inoperable. In terms of surgical approach in the pre-COVID cohort, patients underwent exploratory laparotomies in 54.8% of the cases and laparoscopies in 45.2% of the remaining cases. In the during COVID cohort, most cases were laparoscopies 59.2% and the remaining 40.8% were exploratory laparotomies. The anatomical distribution of the tumor location was similar in both time cohorts. Results showed that the sigmoid colon was involved in 37.5% of the cases in the pre-COVID group and 41.5% of the cases in the COVID group, while the ascending colon was involved in 31.3% of cases in the pre-COVID group and 39.6% of cases in the COVID group. The cecum was the least involved anatomical location for tumors in both pre-COVID and COVID groups, 1 and 3 cases, respectively. As for surgical complications, the most common complication presented by the study population after surgery was acute kidney injury, representing 18.8% of patients in the pre-COVID group and 9.4% of patients in the COVID group.

3.6 Pathologic Staging

Tumor stagings were categorized utilizing the American Joint Committee on Cancer TNM system. It is important to note that some reports had incomplete TNM values, but with the values they did have, staging could be determined. Pathology reports with the TNM classification were further categorized based on TNM combinations into their respective CRC stages. Colorectal Cancer staging includes Stages 1 through 4. Table 1 shows the pathologic staging showing the cross tabulation between pathology and period of admission. Within each period of admission, the most common malignancy in the pre-COVID time was stage 2 with 21.9% of cases and, during the COVID time, it was stage 3 with 30.8% of the cases. In more advanced stagings of CRC, stage 3 and 4, pathology reports showed an overall increase from one time period to another. Within stage 3 malignancy cases, only 27.3% were found in the pre-COVID group, whereas 72.7% were found in the COVID group. Similarly, within stage 4 malignancy cases, only 30.8% were found in the pre-COVID group, while 69.2% were found in the COVID group.

Table 1: Pathology * Period of Admission Crosstabulation

Table 1: Pathology/Period of Admission Crosstabulation

			Period of admission		
			Pre-COVID	During COVID	Total
Pathology	Stage 1	Count	4	10	14
		% within Pathology	28.6%	71.4%	100.0%
		% within Period of Admission	12.5%	19.2%	16.7%
		% of Total	4.8%	11.9%	16.7%
	Stage 2	Count	7	9	16
		% within Pathology	43.8%	56.3%	100.0%
		% within Period of Admission	21.9%	17.3	19.0%
		% of Total	8.3%	10.7%	19.0%
	Stage 3	Count	6	16	22
		% within Pathology	27.3%	72.7%	100.0%
		% within Period of Admission	18.8%	30.8%	26.2%
		% of Total	7.1%	19.0%	26.2%
	Stage 4	Count	4	9	13
		% within Pathology	30.8%	69.2%	100.0%
		% within Period of Admission	12.5%	17.3%	15.5%
		% of Total	4.8%	10.7%	5.5%
	Cannot be determined	Count	11	8	19
		% within Pathology	57.9%	42.1%	100%
		% within Period of Admission	34.4%	15.4%	22.6%
		% of Total	13.1%	9.5%	22.6%
Total		Count	32	52	84
		% within Pathology	38.1%	61.9%	100%
		% within Period of Admission	100%	100%	100%
		% of Total	38.1%	61.9%	100%

3.7 Additional Analysis

A chi square analysis, shown in table 2, compares the period of admission, with outcomes being pre-COVID and during COVID, and metastasis, with outcomes being M0 and M1. It is important to note, as previously mentioned, only 32 out of the 85 patients had known metastasis categories, either M0 or M1, in their reports. The remaining 53 patients were excluded from this analysis due to incomplete TNM staging information. Out of the 32 patients included in this analysis, 20 presented with an M0 category while the remaining 12 patients presented with M1; cancer spread to other parts of the body. Particularly, in the metastasis category (M1), 4 out of the total 12 patients presented from the pre-COVID group; while 8 out of the total 12 patients presented from the COVID group. Utilizing this information of metastasis by period of admission, a p-value of 0.053 was obtained along with an odd ratio of 0.105 (Table 2).

Table 2: Metastasis by Period of Admission in the two time periods

Period of Admission	Metastasis			
	M0		M1	
	Frequency	Percent	Frequency	Percent
Pre-COVID	1	5	4	33.3
During COVID	19	95	8	66.7
Total	20	100	12	100
Variable		n	p-value	Odd Ratio
Metastasis by period of admission		32	0.053	0.105

3.8 Hospital and Intensive Care Unit Length of Stay

The length of stay of patients after their admission to their surgical procedures was taken and divided into their time in the ICU and their total hospital time. The ICU length of stay was an average of 2 days for the pre-COVID group (range of 0-33 days). As for the COVID group, the average length of stay was 1 day (range of the 0-6 days). As for the patient's hospital length of stay for the pre-COVID group, the average stay was of 11 days (range 3-50 days). As for the COVID group, the average stay was 9 days (range 2-30 days). In the end, the patients in both cohorts had a survival rate of 88% in the pre-COVID and 91% COVID. However, some patients expired during the index admission, accounting for a mortality rate of 12% and 9% in the pre-COVID and COVID cohorts, respectively.

4. Discussion

The focus of the COVID-19 pandemic has been COVID patients, whilst non-COVID patients, such as cancer patients, have not had the health services they require in a timely manner [4]. Colorectal cancer, a type of cancer that has screening tests available, had some of the most affected patients. Lack of routine screenings has caused long term effects for colorectal cancer patients in particular because this disease has a progression that is time-dependent [5,6].

In the analysis, patient demographics did not vary significantly with the average age of patients in both pre-COVID and COVID groups averaging above age 64. Gender distributions did not show a significant tendency towards a gender, although male patients did predominate in each of the cohorts. In relation to BMI, most patients were under the category of overweight and obese. As is known, obesity is a known risk factor for CRC and the patients in this study represented this factor in both period groups [7]. In terms of the American Society of Anesthesiology Physical Status Classification System, patients in the COVID group presented with greater ASA scores, meaning more comorbid conditions as compared to the healthy or mildly compromised patients in the pre-COVID group. With this, systemic comorbidities included hypertension and diabetes. In particular, diabetes type 2 has shown to have a relation to CRC as a predisposing risk factor [8].

As per our hypothesis, patients presenting in the COVID group would have acute presentations since they could not get the routine screenings to diagnose the polyps that would later turn into CRC [5]. When comparing both time periods, patients in the pre-COVID group presented mostly for elective surgeries. This shows that in a time prior to COVID, regular screening and scheduled interventions potentially was leading to less severe presentations, lower staging of CRC and increased survival outcomes. Meanwhile, most patients in the COVID group presented with acute symptoms such as

GI bleeding and obstruction. Thus, there was an overall decrease in elective surgeries and increase in acute presentation in the COVID period when compared to the pre-COVID period. Upon patient admission, history of colonoscopies was important information to gather. When compared to the pre-COVID group, the COVID group showed a decrease in the percentage of colonoscopies done within one year of surgical intervention (53 to 40 percent) and an increase in the percentage of patients with no previous colonoscopies (34 to 53 percent). Patients were not getting their routine colonoscopies during COVID due to the limitations and security measures established at hospitals. Above this, the fear of exposure to COVID-19 was also a factor that played into postponing colonoscopy procedures [9].

In respect to surgical approaches, all patients in the pre-COVID group underwent their respective surgery. The most common surgery being a hemicolectomy with primary anastomosis. However, not all surgeries in the COVID group were operable due to advanced stages upon diagnosis. This is sustained because if the patients could not get their adequate screening on time, the tumor size would keep on progressing. It is important to note that CRC has a long lead time, but detecting a tumor before advance staging is critical to improve the prognosis of patients. In the same means of safety precautions, during COVID, the most common surgical approach was laparoscopic. During COVID, minimally invasive procedures were preferred to reduce the risk of aerosolized transmission [10]. In terms of tumor location, the patients in this study followed the trend having tumors located in the rectosigmoid colon, as previous data has highlighted (11).

Moreover, the pathology reports demonstrated that patients presenting with advance staging, that being stage III and IV, showed a percentual duplication and triplication, respectively, in the COVID group, as compared to those of the pre-COVID group. Cancer upstaging was clearly seen with results. In the pre-COVID cohort, the most common malignancy was Stage 2, whereas in the COVID group it was Stage 3. Within Stage 4 malignancies, most cases were found in the COVID group as well. The analysis of metastasis and admission period showed a borderline significance (p=0.053, 95% CI 0.01-1.1) and an Odds Ratio of 0.105. That is, patients in this study had a 0.105-fold lower chance of developing metastasis in the admission period prior to COVID than those who were admitted during the COVID period. Lastly, it was seen that patients in the COVID period had a shorter ICU and hospital length of stay. With the health restrictions and distancing taking place during the lockdown, hospitals wanted to further limit the spread of COVID in their facilities by keeping postoperative patients hospitalized for the least amount of time possible. The contraction of COVID in a postoperative cancer patient would prove detrimental to the recovery efforts after the surgical procedures [12].

In terms of impact, this study highlights the healthcare system's need for effective emergency preparation in the face of events such as pandemics. This comes to show that the healthcare system is not structured to prioritize preventative medicine; rather, it predominantly focuses on the management of acute and chronic disease presentations. During COVID-19, patients screening was affected as fear of exposure to virus and regular medical appointments postponed. However, proper preventative measures in the face of these limitations could include the use of telemedicine and screening appointment reminders via phone call or text message could prove to be valuable tools in bridging the gap towards continuous patient-doctor interactions. Another potential initiative might involve sending colorectal cancer symptom surveys to at-risk patients to better prioritize their urgent need for appointments and screenings. Furthermore, although our study's main focus was to analyze the Coronavirus-19's effect on CRC by comparing two-time cohorts in terms of disease diagnosis, treatment and prognosis, this study also highlights the need to study the long-term effects of delaying a patient's routine procedure in other conditions such as breast and prostate cancer.

Overall, the findings in this study were of borderline significance due to some limiting factors. Some medical records lacked information on core study variables such as BMI, comorbidities, substance use, colonoscopy screenings, etc. Also, some pathology reports also lacked the complete TNM classification, which significantly decreased our initial study population to only patients with known M0 or M1. This is a very important factor that affected the significance of our results. Lastly, being a retrospective study, the study population was limited to 85 patients, a sample which does not allow us to generalize our conclusion to an entire population. As for the continuation of this study, the inclusion of other hospital and general surgery clinics in our database would allow for a more comprehensive picture and would validate or refute the significance of the findings of this study.

5. Conclusion

Colorectal Cancer patients were just some of the many affected by the Coronavirus 19 pandemic. Delayed colonoscopies resulted in a late diagnosis, when the cancer had advanced further, leading to more aggressive tumor development and thus more complex prognosis for patients. When comparing the two-time cohorts, pre-COVID and COVID, it was demonstrated that patients in the pre-COVID group had better odds as to having timely colonoscopies, early CRC stages and thus a better prognosis. Nonetheless, there was no significant difference in the pathologic diagnosis between time periods. As well as no significant difference in patient demographics and presentation of CRC in both groups. For future continuation of this study, a larger population sample should be attained by compiling patient medical records from this time period and scenario from other local clinics and hospitals.

Author's note: Alexandra Schoene Ruiz, MD and Maralexa Martínez-Valcárcel contributed equally to this work.

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